

anaerobic respiration

Why?

At the start of intense exercise, oxygen demand inevitably exceeds oxygen provision.

Therefore, with O_2 to accept the hydrogen and the electrons at the culmination of the electron transport chain, oxidative phosphorylation ceases and the $NADH + H^+$ produced by glycolysis, the link reaction and the Krebs cycle isn't oxidized. Without this oxidation, which provides NAD, the respiration reactions cannot continue.

The work around

The $NADH + H^+$ from glycolysis **can** be oxidized without O_2 to create! This is achieved by the reduction of pyruvate to lactate, which allows the oxidation of the $NADH + H^+$ to NAD.

However, although this allows respiration to continue without O_2 , it is very inefficient, creating just 2 molecules of ATP per glucose molecule, as opposed to the 38 allowed by aerobic respiration.

The result

The build up of lactate leads to the creation of lactic acid, which leads to the pH of the cell falling dramatically. This inhibits enzyme catalysed reactions- including glycolysis, as the positive H^+ ions gum up the negatively charged groups in the active site of the enzyme.

Therefore, an **oxygen debt** has been created; also known as **post-exercise oxygen consumption**. After exercise, oxygen is used to convert the lactate back to pyruvate, where it is oxidised into CO_2 and water via the krebs cycle, releasing ATP. Some lactate may also be converted into glycogen and stored in the liver.

ATP/PC system

This is what is actually used initially in any sort of exercise; it only lasts for 6-10 seconds. It avoids respiration entirely by using **creatine phosphate (or phosphocreatine, PC)** to regenerate ATP:



Therefore :



This is known as the ATP/PC system, and is used for very short, intense periods of exercise such as throwing, lifting or sprinting. The creatine phosphate stores are then regenerated later, when the body is at rest.

Therefore, we have three energy systems acting at different times:

1. ATP/PC system provides ATP for the first 10 seconds
2. Anaerobic respiration [glycolysis] will keep you going for another couple of minutes
3. Aerobic respiration is the main contributor in sports which require more than a few minutes of continuous exertion.

